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IS 11757 (1986): General requirements and acceptance criteria for forklift trucks with capacity from 10 000 kg to 50 000 kg [TED 22: Transport Tractors and Trailers]



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Indian Standard

GENERAL REQUIREMENTS AND ACCEPTANCE CRITERIA FOR FORKLIFT TRUCKS WITH CAPACITY FROM 10 000 kg TO 50 000 kg

1. Scope — Covers the general requirements and tests for verification of stability of forklift trucks with capacity varying from 10 000 kg to 50 000 kg.

2. Terminology

2.1 For the purpose of this standard, the terms and definitions given in IS : 7570-1975 'Glossary of terms relating to fork arms and attachments of forklift trucks, along with the following shall apply

2.2 The rated capacity of a forklift truck is the load, permitted by the manufacturer, that the truck type is capable of transporting or lifting in normal operation under specific conditions.

2.3 The actual capacity of a forklift truck is the maximum load in kg (depending upon its elevating height and/or attachment), permitted by the manufacturer (usually by stability testing), that the subject truck is capable of transporting or lifting in normal operation under specific conditions.

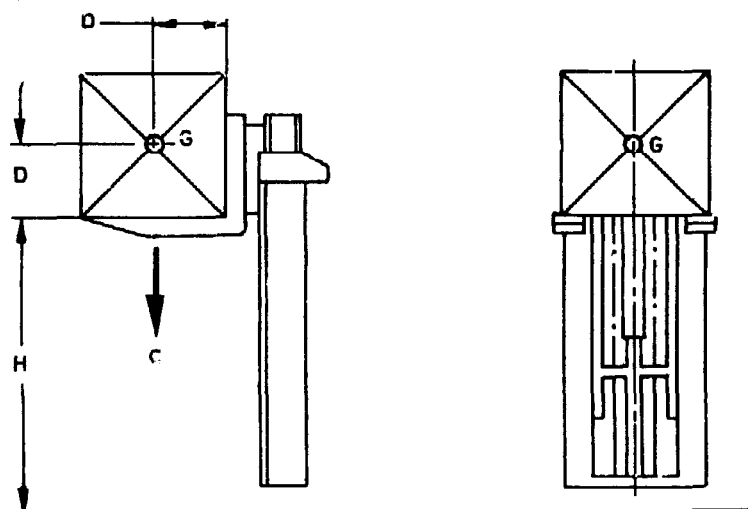
3. Design and Construction

3.1 Rated Capacity

3.1.1 The manufacturer's rated capacity of a truck facilitates the comparison of manufacturer's basic models and is related to a standardized lift height. It shall correspond to the maximum load, C , which it is designed to carry and stock on fork arms or platform, with a vertical double mast, the maximum lift height of which is equal to the standard lift height, H , as specified in 3.1.2 and with a load centre distance, D , as specified in 3.1.3 measured horizontally and vertically between the centre of gravity of the load and and:

- the front face of the fork shank or equivalent dimensions in the case of trucks fitted with a platform;
- the upper face of the fork blade or equivalent dimensions in the case of trucks fitted with a platform (see Fig. 1).

Note — Even if the truck does not utilize a double mast or does not lift to the standard lift height, H , it shall still be given a rated capacity as if the mast was available.



D = standard load centre distance,
 G = centre of gravity, positioned in the longitudinal plane of symmetry between the mast uprights,
 H = standard lift height, and
 C = load.

FIG. 1 POSITION OF CENTRE OF LOADS FOR COUNTERBALANCED FORKLIFT TRUCKS

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3.1.2 Lift height — The lift height shall be fixed as mutually agreed between the manufacturer and the purchaser.

3.1.3 Standardized load centre distance — The standardized load centre distance, D , used for rating shall be as follows:

| Rated Load, C kg | | Standardized Distance, D mm | | |
|-----------------------|----------------------|----------------------------------|-----|------|
| From (included) | To (excluded) | 600 | 900 | 1200 |
| 10 000 | 16 000 | × | + | + |
| 16 000 | 20 000 | + | × | + |
| 20 000 | 25 000 | — | + | × |
| 25 000 | 50 000 (included) | — | — | × |

3.1.3.1 The standard load centre distances are designated by '×'. Load centre distances designated by '+' are optional.

3.1.3.2 It is permissible to rate trucks for special applications with load centre distances related to the application.

3.2 Actual Capacity

3.2.1 The actual capacity of a truck is derived from the appropriate stability tests and shall vary with different types and heights of mast fitted and different load centre distances (see 3.1.3) used in the rating. The rating shall be determined with fork arms or platform provided by the manufacturer. Additional actual capacity ratings with removable attachments may also be established where permitted by the appropriate stability specification.

3.2.2 The forklift trucks (travelling with the load at normal travelling height and stacking) handling freight containers shall have satisfactory stability when reasonably and appropriately used in conditions where the wind speed is up to 45 km/h (Beaufort Scale Force 6).

3.3 Lifting and Tilting Mechanism

3.3.1 Chains — Only leaf and roller mechanism chains shall be used. When the lifting mechanism includes a chain or chains, the truck manufacturer shall select chain, which in relation to the minimum breaking load certified by the manufacturer of the chain, shall provide a factor, K (as given by the following formula) in relation to the static load that would exist in a single chain or in equally loaded chains when the maximum rated load is in the transporting position, assuming no friction in the mast structure:

$$K = 5 - 0.2(C - 10) \text{ with } K \geq 3.8$$

where

C = truck rated capacity in tonnes, and

$$K = \frac{\text{Minimum breaking load per lift chain or wire rope when new} \times \text{Number of lift chains or wire ropes}}{\text{Carrying capacity of truck} + \text{Dead weight of lifting device}}$$

3.3.1.1 Pulley diameter shall be at least 3 times the pitch of the chain.

3.3.2 Wire ropes — When the lifting mechanism includes a wire rope or wire ropes, the truck manufacturer shall select a wire rope which, in relation to the minimum breaking load certified by the manufacturer of the wire rope, shall provide a factor, K (see 3.3.1) of at least 6/1 in relation to the static load that would exist in a single wire rope or in equally loaded wire ropes when the maximum rated load is in the transporting position, assuming no friction in the mast structure.

3.3.2.1 The minimum diameter of the wire rope guide pulleys, measured from the bottom of the groove shall be equal to 22 times the diameter of the wire rope.

3.3.3 Hydraulic lifting system — The descent of the rated load due to leakage in the hydraulic system shall not exceed 100 mm in the first 10 minutes with the hydraulic oil at normal working temperature.

3.3.4 Lowering speed limitation — A control device shall be incorporated in the lift circuit which even in the event of a failure of the hydraulic supply circuit shall restrict the rate of descent speed of the lifting mechanism with its rated load not more than 0.6 m/s.

3.3.5 Hydraulic tilting system — The mean forward tilting speed due to leakage in the complete hydraulic tilting system shall not exceed 0.5° per minute from the vertical mast position with the rated load raised to a height of 2.5 m or in the case of trucks with a lift height of less than 2.5 m, at their maximum height.

3.4 Fork Arms

3.4.1 The dimensions and tolerances of fork arms shall be as given in IS : 6876-1972 'Technical characteristics and testing of fork arms for forklift trucks', along with the following changes:

| Table 1 | Table 2 | Table 3 |
|-------------------|-------------------------|---------------|
| Add 100, 120, 140 | Add 250, 300 in 'b' | Add 250 × 100 |
| | Add 2 200, 2 400 in 'f' | 300 × 100 |
| | | 300 × 120 |
| | | 300 × 140 |

3.4.2 Testing — The testing shall be done in accordance with IS : 6876-1972 but the test load shall be:

$$F_t = fQ$$

where

f = factor of safety, and

Q = fork arm capacity as specified by the manufacturer.

In addition, the tests given in 3.4.2.1 to 3.4.2.4 shall also be carried out.

Note — For trucks with capacity $C > 10$ and equipped with atleast two fork arms, the factor of safety may be set to:

$$f = 3 - 0.08 (C - 10)$$

with $f \geq 2.5$

where

f = factor of safety, and

C = rated capacity of the trucks in tonnes.

3.4.2.1 All fork arms shall be tested for flaws on the surface as well as for internal flaws.

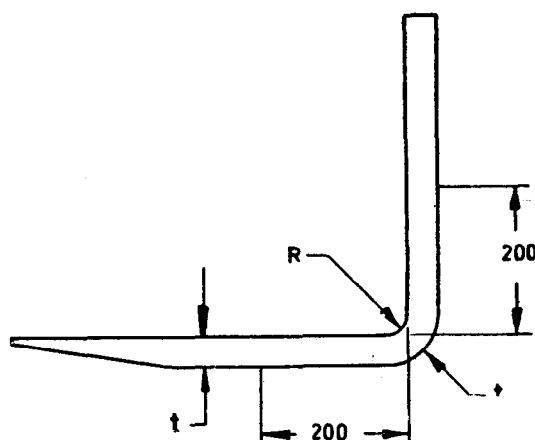
3.4.2.2 Surface flaws shall be tested in the area around the bend and at welds by magnetic particle flaw detection test in accordance with IS : 3703-1980 'Code of practice for magnetic particle flaw detection (first revision)'.

3.4.2.3 Internal flaws shall be tested by ultrasonic testing in accordance with IS : 3664-1981 'Code of practice for ultrasonic pulse echo testing by contact and immersion methods (first revision)'.

3.4.2.4 The ultrasonic testing shall be made with normal probe from perpendicular sides in the same cross-section of the tested object.

3.4.3 Acceptance criteria

3.4.3.1 The hardness shall be within the tolerance required to give stated ultimate tensile strength for the fork arm material.



All dimensions in millimetres.

FIG. 2 FORK ARM

3.4.3.2 Fork arm that at inspection for surface flaws shows linear flaws of a length exceeding 3 mm, shall be not accepted.

3.4.3.3 Linear flaws with a length less than 3 mm shall be considered as continuous.

3.4.3.4 Fork arm with more than 5 indications per dm^2 shall not be accepted.

3.4.3.5 If fork arms inspected by ultrasonic testing at the bend and 200 mm outwards on the blade and the shank (see Fig. 2) for internal flaws, give indications corresponding to a flat-bottomed hole with a diameter >6 mm and/or reductions of bottom response >30 percent, they shall not be accepted. Acceptance criteria applicable for other parts of the fork arm shall be as follows:

- a) Indications corresponding to flat-bottomed holes with diameter >8 mm shall not be accepted.
- b) Indications corresponding to a flat-bottomed hole with diameter 6 to 8 mm and a propagation 200 mm shall not be accepted, and
- c) Reduction of bottom response $>50\%$ shall be accepted.

3.4.4 Marking of fork arms

3.4.4.1 Each fork arm shall be permanently marked with its specified capacity, Q , and the specified load centre distance, D .

Example: 18 000 kg \times 900 mm

3.4.4.2 For fork arm, with safety factor $f < 3$, the specified capacity, Q , shall be given for both $f = 3$ and $f < 3$.

Example: 20 000/22 000 kg \times 1 200 mm

3.4.4.3 The marking position on fork arms shall be as shown in Fig. 3.

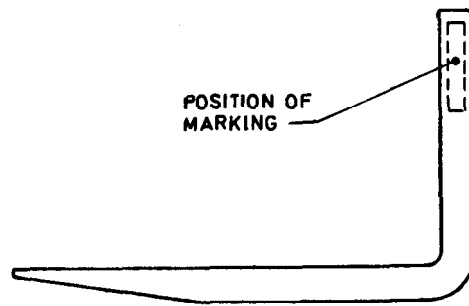


FIG. 3 POSITION OF MARKING ON FORK-ARMS

3.4.5 Maintenance—Repair of fork arms in service on fork lift trucks shall be carried out in accordance with IS : 7617-1984 'Code of practice for maintenance of forks for forklift trucks'.

3.5 Controls and Control Symbols

3.5.1 Controls and control symbols shall be as given in IS : 7496-1974 'Specification for direction of travel-controls for industrial tractors and powered industrial trucks' and IS : 7553-1975 'Specification for control symbols for powered industrial trucks' respectively.

3.6 Power System and Accessories

3.6.1 General requirements for internal combustion engine trucks using diesel/petrol or liquid petroleum gas (LPG) shall be as given in IS : 6305 (Part 2)-1980 'Safety code for powered industrial trucks: Part 2 Manufacture (first revision)'.

3.7 Service Brakes—The service brake performance shall be in accordance with IS : 9701-1980 'Specification for brake performance of powered industrial trucks', with the changes as given in Tables 1 and 2.

3.7.1 Service brakes shall be tested either by minimum drawbar pull as given in Table 1 or by stopping distance as given in Table 2.

3.8 Stability Requirements

3.8.1 For each series of trucks, the tests shall be carried out by the manufacturer on a sample and shall thus ensure that all trucks of that series embody similar minimum stability characteristics.

3.8.2 Calculated stability value—Calculated values for stability may be used for stability determination to avoid extensive repetitive testing. Calculated values which include allowance for

TABLE 1 MINIMUM DRAWBAR PULL (F) PERCENTAGE OF GROSS VEHICLE WEIGHT AT MAXIMUM SERVICE BRAKE CONTROL FORCE

(Clause 3.7)

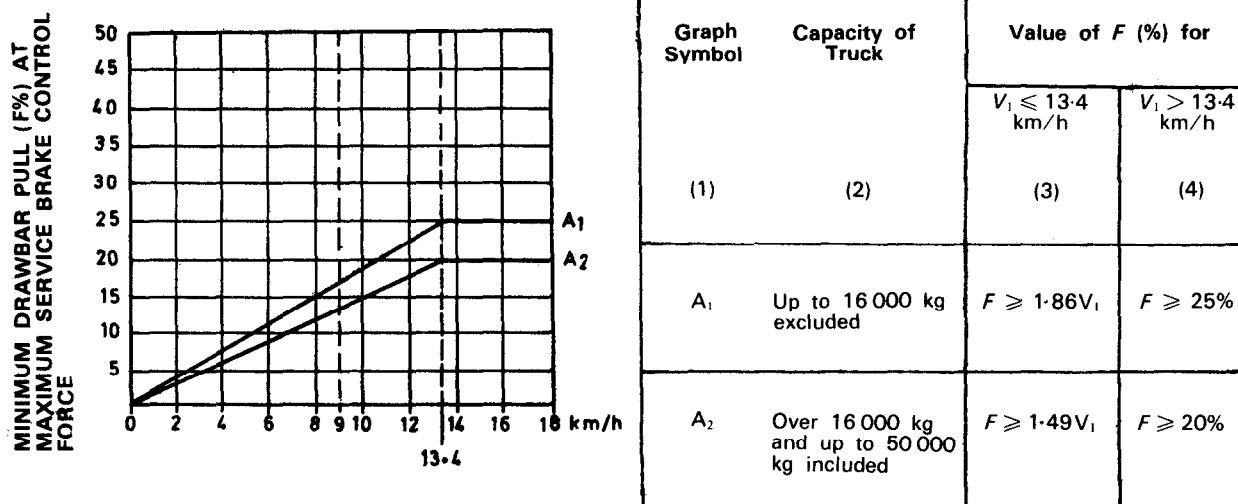


TABLE 2 BRAKE PERFORMANCE

(Clause 3.7)

| Truck Speed with Rated Load | Approx Theoretical Distance After Brake Stop from Full Speed |
|-----------------------------|--|
| km/h (1) | m (2) |
| 2 | 0.43 |
| 3 | 0.64 |
| 4 | 0.85 |
| 5 | 1.06 |
| 6 | 1.27 |
| 8 | 1.70 |
| 10 | 2.12 |
| 12 | 2.54 |
| 14 | 3.09 |
| 16 | 4.03 |

manufacturing variations, tyre, mast, carriage and other deflections shall provide a means for predicting stability with reasonable accuracy. When comparing calculated and test values, the test values are considered the true measure of stability. Due to the difficulty and danger of testing trucks above 10 000 kg at 600 mm rated capacity, calculated values are acceptable in lieu of actual tilt platform tests.

3.9 Lifting Capability — Lifting capability of hook, eye and members, if provided, shall be as per the agreement between the manufacturer and the purchaser.

3.10 Warning Devices

3.10.1 The truck shall be equipped with a warning horn, whistle gong or other sound producing devices. Visual warning devices such as lights or blinkers may also be installed when requested by the purchaser.

4. Protective Devices

4.1 Protective devices of forklift trucks shall be in accordance with IS : 6305 (Part 2)-1980.

5. Acceptance Criteria

5.1 The forklift trucks of capacity 10 000 to 50 000 kg shall meet with the requirements as laid down in IS : 10517-1983 'Acceptance criteria for forklift trucks' except the requirements laid down in 2.4(e) and 2.5.

EXPLANATORY NOTE

Heavy capacity forklift trucks are generally used for handling freight containers and this standard is prepared keeping in view the heavy traffic of containers in our country. Standardization of such forklift trucks would ensure safe and correct interchangeability of heavy materials.

In the preparation of this standard, the considerable assistance has been derived from FEM Section IV—Industrial trucks 'Safety code for powered industrial trucks', issued by Federation Européenne de la Manutention (FEM).